

SCIENCE.

FRIDAY, JANUARY 22, 1886.

COMMENT AND CRITICISM.

DR. PERSIFOR FRAZER of Philadelphia has recently applied composite photography to testing the genuineness of signatures. He first obtained by composite photography a standard signature, and then he compared this with the signature in dispute. In the case of the composites of the heads on coins, or of portraits, it is tacitly assumed that the variation observed is due to a difference of the subject at different times, or to the different impression which the same subject makes on different artists. In the case of handwriting, however, the will-power of the writer attempts to reproduce exactly a certain combination of symbols in the same order as that usually performed; but the accidental physical obstacles or mental influences render this impossible. *A priori*, it would seem likely that a composite of a larger number of signatures would show an individuality little less distinct than the race, family, or pathological characteristics which thus far it has been the aim of those who have used this method to portray. In point of fact it turns out to be the case; but what was not foreseen is equally true; viz., that the very variations which appear on the plate, either as very faint lines or as blurs, furnish the most valuable aid in determining whether or not two pieces of writing are by the same hand. On examining carefully each letter of a composite made from a large number of signatures, it is found that the variations in writing a letter at different times, are confined to certain of its parts, and are not distributed equally over the entire field. Thus not only is there more uniformity in letters and parts of letters which lie close to the line, but in the upper loops, dots, and crosses, the tendency in all cases thus far examined is towards variation in one, or at most two, directions; and these are restricted more than one would suppose, who regards without critical analysis the writings from which the composites were made. It would be premature at this time to say with what certainty one might tell, after an extensive experience of the use of this sort of analysis, that two writings were or were

not by the same hand. But the great gain, after all, is not altogether in the certainty which the method renders possible (though this cannot be ignored), but in the fact that it removes the judgment on affairs as delicate and often as important as the identification of handwriting from the possible bias of personal expert opinion, and allows the testimony of the photograph to be weighed by judge and jury like any other testimony. So far as Dr. Frazer has yet been able to observe, it is impossible to write naturally the signature, or even the hand, of any other person, without showing numerous discrepancies with the composite plate. The essential requisites to making the plate are of course as many signatures as possible, about which there can be no suspicion. In order to make the letters overlap as much as possible, it is sometimes found necessary to photograph them at different distances from the camera. It is a curious fact, that, when a man is obliged to restrict his whole signature to a space less than that to which he is accustomed, he will insensibly make a change, which is usually a close approximation to a reduced scale.

IN THE NUMBER of *Science* for last week we noticed the railroad running across the deserts of Asia towards Merv and Bokhara. This week we wish to call attention to the first well-developed plan for the construction of a railway connecting the interior of Africa with the Atlantic Ocean. On the 23d of December, 1885, an agreement was made at Brussels, between the independent state of Kongo, and delegates from the Kongo railway company of Manchester, granting to this company the right to construct a railway to connect the upper and lower Kongo. The delegates of the English company were Messrs. Hutton, M.P., president of Manchester chamber of commerce; Mackinnon, director of the British-Indian steam navigation company; and Stanley. The directors of the railway company are the three delegates before mentioned; and Messrs. Adamson, president of the ship-canal to connect Manchester with Liverpool; Jacob Bright; Lord Egerton; Sir James Ferguson, M.P., and former governor of Bombay; W. H. Houldsworth, M.P.; and H. M. Steinthal of Manchester. The capital

will be five million dollars, and subscriptions will be immediately opened in the capitals of the four states which signed the general act of the conference at Berlin. The railroad will be constructed within the territory of the state of Kongo, either on the south side of the river, between the frontier and Leopoldville, or in two sections, — one on the right bank of the river, and the other on the left.

LIEUTENANT TAUNT of the U. S. navy recently arrived in London from the Kongo, where he has been on a mission for the government. Mr. Tisdell's report of a visit to the lower Kongo, in which he painted so black a picture of unsuccess and sterility, will be fresh in the memory of our readers. The report which Lieutenant Taunt has to render bears a very different complexion: he did not content himself with a hurried visit to Vivi and Stanley Pool, but went as far as Stanley Falls. He describes the lower Kongo as in the main barren, but even there relieved by fertile spots. The administration of the Kongo state is severely criticised. Lieutenant Taunt finds that in the lower Kongo the officials do not retain their offices long enough: this is presumably to be credited to the extremely unhealthy climate, although no such reason is given by Lieutenant Taunt. On the upper Kongo he found the officials better contented, and the administration more satisfactory. It is understood that there is no prospect of Mr. Stanley proceeding to the Kongo in the near future; and there is a tendency to withdraw all officials not of Belgian nationality. Sir Francis de Winton has retired, and has been succeeded by N. Janssen. These changes may result in doing away with the jealousies formerly existing among the officials of different nationalities.

THE DECLINE OF CHOLERA in southern Europe has afforded ground for the hope that the epidemic had nearly ceased, or at least that the worst was over. From recent news, however, it appears that there yet exists cause for apprehension. The disease has broken out in the provinces of Cadiz and Malaga, and quarantine has been established at several seaports. It has approached the frontiers of Portugal, and it is very possible, if not probable, that it may break out with its previous intensity in the spring. Not only in Portugal, but in various provinces of Spain, evidence seems to indicate that the end of the epidemic is not yet.

ON ANOTHER PAGE will be found the proceedings of the first meeting of the Indiana academy of sciences. This society enters upon its existence under auspicious circumstances, and its future progress will be watched with interest. The list of names of the officers or participants, as given, includes not a few of men of acknowledged ability; and there certainly seems to be sufficient material among the scientific workers of Indiana to make the academy a success. Other state academies have led a feeble existence, from lack of material or proper management; may it be hoped that the future of the present one will be brighter.

THE COMPETITION OF CONVICT LABOR.

BACK of all the discussion as to the various methods of employing convicts, one of which was commented on in a recent number of this journal (*Science*, No. 153, p. 28), lies the complaint that any method whatsoever of utilizing convict labor, save in the work about the prisons, results in a competition with free labor which is unfair and injurious.

The idea that this competition really exists in an appreciable amount has taken possession of so many minds, that we offer a few statistics on the subject. It may at once be admitted, that were all the 60,000 convicts in this country employed in a single industry, under one scheme of management, the effect would be that an enormous addition would be made to the productive capacity of that industry, and consequently prices might fall, and a reduction of wages result. But this hypothesis is as far from the truth as possible.

In 1879 Col. Carroll D. Wright ('Eleventh annual report of the Massachusetts bureau of the statistics of labor,' p. 112) stated that such convicts as were employed at any kind of labor whatsoever throughout the whole United States were 40,122 in number, and were distributed among 129 penal institutions. Of this number, 23,524 — 22,288 males and 1,236 females — were employed in 108 kinds of industries requiring skilled labor; 11,668 — 11,450 males and 218 females — were employed in 25 kinds of industries requiring unskilled labor; the remaining 4,930 were employed in prison duties. These 23,524 convicts, employed in productive skilled work in the prisons of the United States, were competing (*ibid.*, p. 114) with 666,625 workmen employed in the same states upon the same kind of work, and with 1,269,240 in the whole United States engaged in the same productive industries that were carried on in the prisons: therefore the percentage of convicts to free laborers was 1.83.

Small as this makes the force of the competition appear, the real effect is smaller still. The competing power of the prisons was, as appears above, 23,524 convicts. But, relying on the most scientific tests and measures that the English prison managers have been able to apply to the productive force of convict labor, we find that it takes the labor of two convicts to equal that of one free laborer (see 'Report of the superintendent of state prisons of the state of New York for the year 1884,' p. 24). This results, of course, from the low mental and moral equipment of the average convict, as well as from the peculiar conditions under which prison labor is carried on. As it is a well-known fact that the artisans in the United States accomplish more work in a given time than their European competitors do, it will be necessary to allow for a somewhat higher standard of convict labor. Putting this allowance at 10 per cent, we find that the productive labor of an American convict is 60 per cent of that of the free workman.

Therefore, while the percentage of convicts to free laborers was 1.83, the competitive productive power of the former was only three-fifths of that, or 1.1 per cent. And it is this minute percentage of competition that has caused all the hue and cry against convict labor.

In a recent paper on 'The rate of wages,' Mr. Edward Atkinson, of Boston, basing his statistics on the census of 1880, states that 17,400,000 persons are engaged in some gainful occupation. Of this number, 150,000 are in government employ: so there remain 17,250,000 producers, who, by exchanging products with others, also obtain the means of living, and thereby become consumers. 1,050,000 of these are engaged in mental rather than manual work; such are clergymen, lawyers, teachers, artists, chemists, engineers, officials of banks, railroads, insurance companies and corporations, merchants, traders, and dealers. When these are deducted, we have a remainder of 16,200,000, who constitute the actual working-class. 7,000,000 of these are farmers and farm-laborers, and the rest are artisans, mechanics, clerks, laborers, operatives, domestic servants, and other wage earners. The products of the mechanical industries of the United States amount to more than five thousand million dollars annually. The total product of the state prisons of the country is not over twenty millions per annum, or two-fifths of one per cent of the whole manufactured products of the country; and this figure is obtained by taking prison labor at a valuation of two dollars per day,—the average price for labor outside of prisons. As the convicts earn, on an average, only forty cents a day, their earnings represent a product of less than one-fifth

of one per cent of the products of the United States.

We are convinced that those who participate in the crusade against the employment of convicts in productive industries on the ground of unfair competition with free labor, are innocent of any acquaintance with the facts and figures that bear on the question. NICHOLAS MURRAY BUTLER.

THE NEW VOLCANO IN THE PACIFIC.

THE *New Zealand herald* of Nov. 3 contained the following account of the recently reported new volcano in the Pacific:—

"In yesterday's paper we stated the news brought by the schooner Maile, that a new and vast volcano had arisen in the Pacific Ocean. A correspondent in Tonga, dating Oct. 19, gives the following particulars: 'At daylight on the 13th of this month (October) we observed dense volumes of steam, smoke, and clouds, ascending in a N. N. W. direction. At one o'clock P.M. on the same day proceeded in the Sandfly in that direction, having on board the Premier, Mr. Baker, Mrs. Baker, two Misses Baker, Mr. S. W. E. Baker, Miss Tuckow, Dr. Buckland, Rev. Mr. Watkin, Mr. F. Watkin, Mr. Wilson, Mr. S. Roberts, Prince Liponie, Chief Tongi, and several others; sailed sufficiently close that evening to see that it was a submarine volcanic eruption. Considering it not prudent to approach it any closer, night coming on, and thinking there might possibly be a set of currents towards it, shortened sail, and worked to windward of it, keeping it at a respectable and comfortable distance from us during the night. In the morning at daylight made sail with a fresh breeze from E. S. E. About eight A.M. my judgment was, we were about $1\frac{1}{2}$ to 2 miles from the crater, it bearing then about N. W. I have not words to express my admiration and wonder at its changing splendor. Eruptions take place every one or two minutes, changing its appearance every second like a dissolving view. I can only say it was one of the most awfully grand sights I ever witnessed in all my life on the high seas. And now for the position, as near as I have been able to calculate at present, of the island that has been thrown up by this volcanic eruption. It is on the S. E. edge of Culebras reef, as placed on the chart by H. M. S. Falcon in 1865, and N. N. W. $\frac{1}{2}$ W. magnetic, 14 to 15 miles from the island of Honga Tonga. As to the size or extent of the island thrown up, I am at present unable to state correctly, there being so much steam and clouds hanging about and over it; but I should imagine, from what little I could see of it, that it was from 2 to 3 miles long, S. W. and N. E.; height about

60 ft.; lat., $20^{\circ} 21' S.$; long., $175^{\circ} 28' W.$ position of Sandfly Island, for we saw it rise. Got back again just too late to enter the reefs to Tonga. Anchored at Nukualofa at ten A.M. on the 15th. We had lovely weather all the time, a nice S. E. wind, and every one seemed highly gratified with what he had seen."

THE RECENT COLD WAVE.

THE accompanying minute maps are reduced from daily weather-charts published by the signal service, and represent certain features of the weather during the passage of the recent severe cold wave. The series of six maps (figs. 1 and 2), designed to show the changes of temperature from Jan. 7 to Jan. 12, are crossed by a heavy line that marks the altitude of $0^{\circ} F.$ as determined by the observations at 7 A.M. on successive mornings.

At the same time an area of high pressure, with very low temperatures, stood in the far north-west. As is stated by Lieutenant Woodruff in his recent note on cold-waves, areas of high pressure extend to the south and east with their low temperatures, while the antecedent storm-centres move off to the north-east. The wave here considered belongs to the third of Woodruff's classes, inasmuch as it first spread southward to Texas, and then east and north-eastward to the Atlantic coast. On Jan. 8, when the storm-centre was near Mobile, a fine 'norther,' such as would have delighted Redfield, swept down the plains to the Gulf, and Galveston was only about ten degrees warmer than Duluth. The zero isotherm stood just west of the Mississippi, running nearly north and south for about seven hundred miles. During the next three days, while the storm moved off over Labrador, the cold wave crept up the Ohio valley, where the temperature

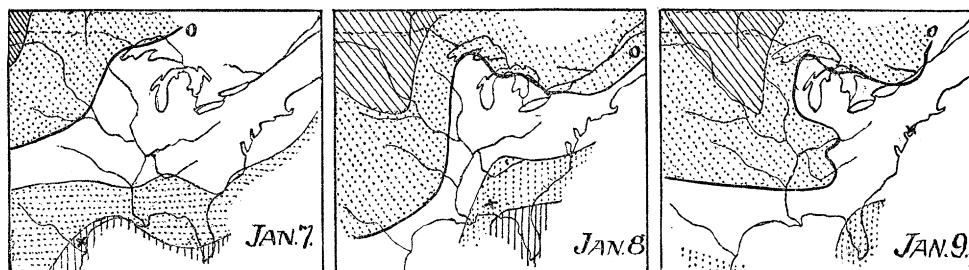


FIG. 1.

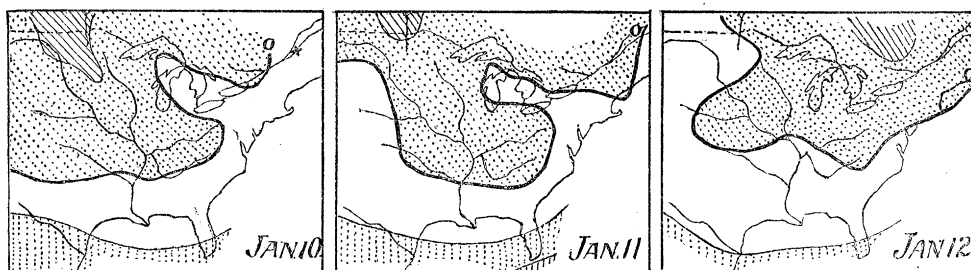


FIG. 2.

To the north of it, the dotted area extends to the isotherm of 30° below zero; the space shaded with lines, farther north, being colder still. The unshaded part of the maps contains the temperatures between 0° and 30° above; the next belt covers temperatures from 30° to 50° ; and in a few of the maps, temperatures above 50° appear in the extreme south.

On the morning of Jan. 7, a storm-centre of moderate intensity lay in southern Texas, having come across northern Mexico from the Pacific; at

then stood distinctly lower than in Michigan, two hundred miles farther north. At last, on Jan. 11 and 12, the zero isotherm turned well north over the plains as more moderate temperatures returned.

The most interesting phase of this spell of weather was doubtless that presented on the morning of Jan. 9, when the storm had developed into a true cyclone, with nearly circular isobars, and remarkably low pressure at its centre in southern New Jersey. At this time the barometer

at Philadelphia read (reduced to sea-level) 28.69; it was 30.81 in the anticyclonic centre near Lake Winnipeg, a difference of over two inches in only

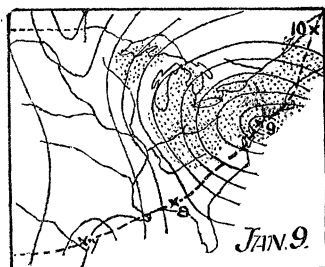


FIG. 3.

1,400 miles. This is illustrated in fig. 3, which gives the isobars for every even tenth of an inch; it shows also the area (dotted) over which snow was falling at this time; and the storm-track is traced by a heavy broken line, with a cross and a date to mark the place of the centre at seven o'clock in the morning while it lay within our territory. The numerous wrecks along our coast attest the violence of the winds at this time. When the monthly weather review for January comes out, we shall hope to find a detailed account of this storm, especially from those stations along the coast that lay close on the path of its centre.

Fig. 4, for the same date, is designed to illustrate the extraordinarily low temperatures brought by the cold wave in the rear of the cyclone. The

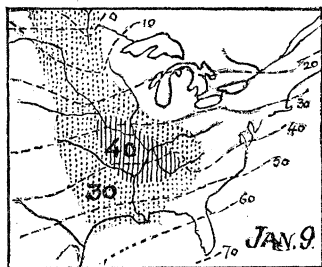


FIG. 4.

mean temperatures for January are taken from Lieutenant Greely's monograph (1881), and drawn in broken lines for every ten degrees. By comparing these with the six temperature maps above, the amount of departure from the normal may be estimated. The departure for Jan. 9 is given by two shaded areas, showing a depression of thirty and forty degrees respectively; this depression being calculated from the mean January temperature at 7 A.M., as given in the chief signal officer's

report for 1884. The temperatures reached in the southern states on this and the following days are in all cases close to the recorded minimum of earlier years, and in many cases are lower than any thing known in the signal-service stations there. Altogether, the storm and the cold wave are perfect examples of their unpleasant kind.

W. M. D.

AMERICAN JOURNAL OF ARCHEOLOGY.

THE fourth number of the *American journal of archeology*, which has just appeared in Baltimore, completes the first volume, and fully sustains the high expectations which were entertained of its management. Nearly five hundred pages, illustrated by eleven plates and sixteen figures, have been given to the subscribers; but the quality of the articles is more noteworthy than the quantity. No other archeological journal of any country affords so comprehensive a view of the progress of investigation and discussion. All important reviews and monographs and books are noticed by competent readers and critics, whose names are appended as authority for the statements which are presented. The proceedings of societies are also recorded. Although chiefly concerned with the archeology of civilized nations, prehistoric remains are not neglected; but the effort is made to represent in one journal all the varied movements of the science. The managing editor, A. L. Frothingham, jun., Ph.D., by his complete familiarity with the French, Italian, and German languages, and by his long residence in Rome, has become acquainted with the leading authorities, and has been able to secure their encouragement, and to a considerable extent their co-operation in his undertaking. A list of those Europeans who have already made, or who have promised at an early day to make, contributions to the *American journal of archeology*, includes the names of such well-known persons as Piper of Berlin; Reber of Munich; Michaelis of Strassburg; Schreiber of Leipzig; Ramsay of Oxford; Babelon, Reinach, Müntz, and de Marsy, of Paris; de Rossi, Marucchi, and Helbig, of Rome; Hildebrand of Stockholm; Lambros of Athens; and many more. Many of our countrymen are also enlisted in the enterprise.

With such an array of names, a good series of papers would of course be expected, and the result has been satisfactory. In the latest number the most noteworthy article is, perhaps, that of Professor Merriam, on that remarkable code recently discovered at Gortynia in Crete. So long ago as 1857, an inscribed stone, built into the walls of a mill on the banks of the Cretan river

Lethaios, was discovered by M. Thenon, and afterwards transferred to the Louvre. Its meaning was deciphered by M. Bréal in 1878. In 1884, Halbherr, a pupil of Comparetti, discovered on the same site four columns, with additional parts of the inscription. A few months later eight more columns were disclosed by Fabricius. Dr. Halbherr returned again last summer to his task, but no additional inscriptions were found. The text thus gradually brought out is now printed with a translation, and with critical comments, by Professor Merriam, who comes to the conclusion that the inscription is probably of the period of Solon. Our space will not permit a fuller account of this wonderful monument, interesting not only to archeologists, but to students of historical law and the history of civilization. Professor Merriam is to continue his discussion in the following number of the journal.

S. Reinach, lately in the French school at Athens, describes a beautiful statue of Artemis, lately discovered, and now in the *Tchinley-Kiosk* museum in Constantinople. The editor, Dr. Frothingham, has an illustrated article on the revival of sculpture in Europe in the thirteenth century, and begins a series of notes on Christian mosaics. The other main article is by Mr. W. H. Holmes, on the monoliths of San Juan Teotihuacan, Mex. Our notice would be incomplete if it did not include a reference to a second article by Reinach on the base of an archaic bronze statue from Mount Ptous, which has an interesting and enigmatical inscription. Babelon's article, running through fifteen pages, on Greek and Roman numismatics, is also full of interest. But, valuable as are all these special papers, many readers will find still greater advantage in having at command, in a single number of this journal, forty-three pages of archeological news from all parts of the world, including fresh intelligence even from Cambodia and Hindustan.

GEOGRAPHICAL NOTES.

Color-sense of the Fijians. — Schwarzbach writes from Sydney in regard to the color-sense of the Fijians, which he has been investigating. They have no abstract word for color, but merely color-names. They have one name for black, which also includes all shades of blue, one for red and reddish tints, for white, for green, and for yellow. When asked to define more exactly some intermediate tint, they use some such phrase as 'it is like a bird.' Having examined over two thousand Hottentots, Malays, Melanesians, Australians, Maoris, and Polynesians for color-blindness, not a single instance was found; and the writer

believes it to be confined to the white race, and a defect due to influences connected with civilized life.

Some local dialects. — Pinart states that the use of the Aino tongue on the Kurile Islands, already affected by the Aleut population brought there by the Russian fur company, has become practically extinct except on Iterup and Urup, the two principal islands. Since the cession of the group by Russia to Japan, the influx of Japanese has been such as to greatly dilute the already sparse population; and it is also said that on the island of Yesso the use of the Aino tongue is rapidly declining, while mixture of blood by marriage with the Japanese is on the increase. The same authority announces that in the midst of the mountains of the Sierra Tutotepec, in Mexico, especially at the village of Huehuetla, is a tribe known as the Tepehuas, or mountaineers, but who call themselves Ulmeca. These people, M. Pinart believes, speak a dialect essentially similar to the Totonak, and are probably the last remnant of the Olmek people referred to by early writers. There are about four thousand of them, and their manners and customs are peculiar in many respects.

Slavery in Madagascar. — In connection with a discussion of the condition of society in Madagascar, some interesting details have recently been made public in regard to slavery on that island. It appears that somewhat more than half of the population of four millions are in a state of servitude. Though the slave-trade has been prohibited, and the individuals brought from Mozambique for sale have been freed by royal edict, there is still in the outlying districts a surreptitious trade in slaves, supposed to amount to several thousand per annum. Of the people recognized as slaves there are two classes, — those of the Hova race, who have become so by the action of law, which prescribes slavery as a punishment for various misdemeanors and for bankruptcy; and the Andovos, who are prisoners of war taken in the conflicts between the Hovas and other indigenes. There are no plantations, and field-work as a regular labor is almost unknown. The free Hovas are not permitted to marry slaves; and, on the other hand, those of the slaves who have become so on account of debt, etc., are not permitted to marry among the Andovos, who are regarded by them as much their inferiors. Slavery with the Hovas takes mostly the patriarchal form. Apart from those employed as workmen or domestic servants, many are practically free, only being required to pay tribute, as of a fagot, for instance, on the Hova New-Year. Those who live with their masters eat at the same board, converse freely with them, and frequently use such terms

of address as would be literally appropriate only from children of the master of the house. Many have houses and farms of their own, giving a share of the crop to the master, who can, but rarely does, claim the whole of it. Slaves can use their earnings to buy their freedom if they can accumulate enough to do so, and they are frequently owners of other slaves. They generally make their own bargains for wages if they go out as porters or domestics, and reckon with their owner themselves. The condition of the slaves is much harder, however, among the Sakalavas, in the north-east part of the island, — a tribe hostile to the Hovas, and still pagans, by an alleged treaty with whom the French have acquired those 'rights' which they have for some years been vainly endeavoring to enforce upon the Hovas. With the latter, since their conversion to Christianity, a gradual and important amelioration has taken place in the matter of slave-holding, and the families of criminals are now no longer liable to be sold into a state of servitude.

ASTRONOMICAL NOTES.

The zodiacal light. — Professor Searle of Harvard college observatory, in a paper recently published, has continued his interesting investigations on the zodiacal light. This peculiar phenomenon is supposed to be due to finely divided matter of some kind illuminated either by direct sunlight or by the result of electrical or chemical action. This matter may be only a portion of the atmosphere or of some cosmical mass more or less homogeneous, but illumination is presumed to be confined within certain limits; and the difficult task of the observer has been to attempt to define these limits. As a result of the present inquiry, there would seem to be reason to think, that after allowing for atmospheric absorption, which probably affects the apparent position largely, the zodiacal light, as seen during the second half of the nineteenth century, has had a more northern latitude near the longitude 180° than near the longitude 0° . Furthermore, from a careful study of the distribution of the stars in the Durchmusterung, Professor Searle shows, that, "upon the meteoric theory of the zodiacal light, it is to be expected that a continuous zodiacal band should be present; but the question of its actual visibility is complicated by the slight maxima of stellar density which are situated along those parts of the ecliptic most readily accessible to observation from stations in the northern hemisphere." And finally, from an examination of the elements of the first 237 asteroids, it would seem that the belt of sky

occupied by the projections of their orbits presents certain peculiarities which correspond to those of the zodiacal light, and suggest the hypothesis that the light may be partly due to minute objects circulating in orbits like those of the smaller planets.

U. S. naval observatory. — Vol. xxix. of the publications of the Naval observatory, now in press, will contain, in addition to the regular series of astronomical and meteorological observations for 1882, a valuable appendix by Professor Hall on the orbit of Iapetus, the outer satellite of Saturn; an appendix by Professor Harkness on the flexure of transit instruments; and a third appendix by Commander A. D. Brown, giving the observations of the partial solar eclipse of 1885 March 16, made at the observatory, and also observations made by several volunteer parties near the line where the annular phase was visible.

Lord Rosse's observatory, Birr castle. — We have recently received two papers communicated by the Earl of Rosse to the Royal Dublin society, and reprinted from vol. iii. (second series) of the Scientific transactions of the society. The first of these papers is a series of notes by Dr. Boeddicker, on the aspect of the planet Mars in 1884, accompanied by a lithographed plate giving thirteen sketches of the markings on the planet's surface. The second paper is also by Dr. Boeddicker, and contains the results of observations made on the changes of heat from the moon during the total eclipse of 1884 Oct. 4. From these observations it would appear that the amount of heat radiated to us from the moon itself, as distinguished from that merely reflected or diffused by it, is almost insensible; and the minimum of the heat effect falls decidedly later than the minimum of illumination.

NOTES AND NEWS.

For many years the exorbitant tax on salt in India has oppressed the lower classes, almost extinguishing some branches of industry. The Indian government has at last become alive to certain objections to the present rates of the salt-tax; namely, that cattle are stinted of a supply of salt, and that the same duty is charged on salt employed in manufactures or agriculture as for that used for other purposes. Experiments, for some time unsuccessful, have been prosecuted with a view of discovering a process whereby salt, while still useful for manufactures and agriculture, could be rendered unfit for human consumption. The government has now offered a reward, not exceeding five thousand rupees, to the inventor of a process satisfying the following condi-

tions: first, that its cost shall not exceed four annas per eighty pounds; and, secondly, that the preparation shall be such that edible salt cannot be extracted from it by the ordinary processes used by native salt-workers.

— The vaccine from revaccinated children is of doubtful protective potency, according to the observations of M. Blot, recently reported to the *Académie de médecine*.

— According to *La nature* of Jan. 2, an interesting ethnological discovery has just been made at Dampont, near Paris. An ancient burial-place of the polished-stone age has been there exhumed, and found to contain various portions of skeletons, implements, pottery, etc. Three crania had been trepanned, and so skilfully that it appears like the work of a surgeon.

— Within late years surgical operations upon the stomach for the extirpation of tumors or the removal of foreign bodies have been attempted a number of times, but almost invariably with unfavorable results. A case, the second on record, is just reported from England, where a large mass of hair, weighing about a pound, was removed from the stomach of a young lady, through an incision five inches in length, with recovery.

— Two editions of Coulter's 'Rocky Mountain botany' (New York, *Iverson, Blakeman, Taylor & Co.*) are offered to the public: one of them is uniform with Gray's manual of the botany of the eastern United States; the other is printed on thin, strong paper, and bound in a flexible and durable cover for the needs of the tourist. Of the merits of the work, it is of course too early to speak. The special descriptions which have been carefully and laboriously brought into a compendious arrangement for practical use by every-day students, must now be subjected to criticism in the fields and parks, and on the slopes of the mountains of the central chain. It will not be surprising if some of the work done in the study will have to be modified by repeated examinations of the specimens in their homes. But, so far as a careful inspection of the attractive pages of this volume can at present show, the work has been conscientiously and thoroughly done, and is a substantial boon to our students of botany.

— The preparation of a new geological map of France, on the scale of 1:500,000, has been undertaken by Messrs. G. Vasseur and L. Carez, according to *Comptes rendus* of Dec. 28. The first parts have been already presented to the academy. The work will comprise forty-eight parts, and will require five years for its completion. Five plates

are already printed, mostly of the northern regions. Each large stratigraphic group will be represented by a single color, with shadings for the subdivisions, as proposed by the international congress at Bologne. The work will be accompanied by a volume of explanatory text.

— The university of Basle, Switzerland, possesses a human skeleton, prepared in 1543 by the founder of anatomy, Andreas Vesalius. It is the only known relic of this greatest of all human anatomists; which fact, together with its great age, makes it especially precious. In the times of Vesalius the dissection of the human body was permitted by the authorities only with the greatest reluctance; and the history of the present skeleton, as recently given by Professor Roth, is particularly interesting. On the 12th of May, 1543, the body of one Jacob Karrer, who had been beheaded, was handed, over to the university for dissection by Vesalius. Not for two years had such an opportunity occurred, and one can imagine the interest with which for many days the students and teachers followed the words and demonstrations of the great master. At the completion of the dissection the skeleton was prepared by his own hands, and presented to the university. It was in this year that his great work on human anatomy, the foundation of the modern science, appeared. Who knows how much we are indebted to this very subject for the discovery of much that is taught to-day,—discoveries for which the author was condemned to death, and escaped only to die in exile from starvation?

— The trustees of Cornell university have filled the newly established Sage professorship of ethics and philosophy by the election of Prof. J. Goold Schurmann, Ph.D., at present professor of philosophy at Dalhousie college, Halifax, N.S. Professor Schurmann is thirty-two years of age, and has studied at London, Edinburgh, and in Germany. As Hibbert travelling scholar, he collected the materials for an essay on 'Kautian ethics and the ethics of evolution,' which attracted some attention among specialists in philosophy when it was published, in 1881.

— Prof. Charles E. Hamlin, of the Agassiz museum of natural history, died at Cambridge, Jan. 3, aged about sixty years.

— Prof. A. M. Mayer, by the use of a simple form of vitroscope with electric registration of seconds, has reached some valuable and interesting results as to the conditions and limits of accuracy in this method for determining the rate of standard forks (*Mem. nat. acad. sc.*, iii.). He has also investigated the amount of change in the

rate of a fork caused by changes in temperature, in the amplitude of vibration, and by the pressure of the style against the paper on which the vibrations are recorded.

LETTERS TO THE EDITOR.

**Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

An early prediction of the decay of the obelisk.

I GIVE below a translation of a portion of a letter from Dr. Alfred Stelzner of St. Petersburg.

"At first I wanted to add to my remarks a comparison between the New York Needle and the Alexander column in St. Petersburg; for the rock of both is very much alike: it agrees even down to the occurrence of handsome little zircon crystals. This comparison would have been made but that it would have been a mournful and unpleasant croak in the triumphant report of Mr. Gorringer, and therefore it had to be abandoned; but privately let it at least be put on record. You know, perhaps, that the Alexander column in St. Petersburg was transported from Finland to St. Petersburg in the thirties of this century at a senseless cost, and, with the assistance of thousands of men, was erected, — a monument for eternal ages, which should remind the beholder of a Russian monarch. But even in a few years the granite did sad honor to its Finnish name of 'Rappakivi,' i.e., the lazy-stone. The granite commenced to weather, and weathered merrily on in spite of all technical and scientific commissions; and one can well say that the years of the proud monument are numbered. It is possible that they chose unsound stone, and that they shook it about too much; so that, in quarrying and transporting it, it became filled with little clefts, and thus gave free play to its disintegration. But General Helmersen explains the affair differently. The granite, he says, contains many large felspar crystals. But the felspar is triclinic, and therefore expands, under the great differences of temperature between the St. Petersburg summer and winter, differently in the directions of its three axes: hence comes the crumbling, owing to the unequal molecular movement throughout the entire mass of the monolith. If this explanation is correct, then from the similarity of the rocks from Finland and Syene, and the great differences between the summer and winter temperature which exist also in New York, an unsuspected danger threatens the old Egyptian monolith, which has always hitherto stood in a mild and equable climate. Perhaps, also, it will succumb to the weakness of old age, for the London Needle of Cleopatra is said to be beginning already to crumble in its new home. You may regard this statement as pessimistic, but a knowledge of the experiences made elsewhere will not injure the New-Yorkers. Perhaps it will lead them to cover up the Needle there with bad conductors of heat during the winter, and thus preserve the venerable old stone monument. In any case, you will agree with me that this comparison should be taken into consideration; but it will not do to insert it into Mr. Gorringer's book, where it would produce a discordant tone. But it is worthy of consideration. . . . Thus I wrote in 1882, and I regret that I was not mistaken. But the children of the tropics, be they palms or granite columns, will not stand a northern winter in the open air. For the

rest, one will interest himself now more than formerly in the observations which have been made in other places. I take the liberty, therefore, of calling your attention to the memoir by Struve: 'The Alexander monument and the Rappakivi. A contribution to the better knowledge of the Finnish granites. St. Petersburg, 1863-64.'" F. R.

Sea-level and ocean-currents.

The recent important determination of the coast and geodetic survey, by levelling up the Mississippi valley and across to the Atlantic coast, that the mean level of the Gulf of Mexico at the mouth of the Mississippi is about one metre higher than that of New York harbor; and the similar result obtained by Bourdaloue, by levelling across France, namely, that the mean level of the harbor of Brest is 1.02 metres higher than that of the Mediterranean at Marseilles, — furnish an interesting subject for study, and important facts for explanation by physical geographers. If, as it seems, the surface of the ocean is not level and at rest, what are the forces which cause it to deviate from a perfect level, and to have ascending and descending gradients in different parts, and currents running in various directions?

There are two principal causes for this disturbance of sea-level, — the one, the difference of level between the equatorial and polar regions, arising from a difference of temperature of the sea in the two regions; and the other, the deflecting force depending upon the earth's rotation. The first is the real cause of disturbance, the latter being simply a modifying influence of the effects of the former, which changes, or tends to change, the directions of motion, but does not give any addition of real force.

According to Mr. Croll (*Climate and time*), as deduced from the soundings of the Challenger expedition, if the water of the upper strata were prevented from flowing away toward the poles, the level of the ocean at the equator, on account of its greater temperature, would be 4.5 feet higher than the level at the parallel of greatest diversity of sea-water, a little beyond the polar circle. This greater upward expansion in the equatorial region, however, does not change the pressure at the bottom of the sea; and its initial effect is to give rise in the upper strata to gradients of pressure decreasing from the equator toward the poles. This causes a flow of the water of these strata from the equatorial to the polar regions, and this decreases a little the pressure at sea-bottom in the former, and increases it in the latter, and consequently gives rise to a gradient of decreasing pressure, and an under-current, from the polar regions toward the equator. Hence there is now an interchanging circulation, a motion of the water of the upper strata from the equatorial region toward the poles, a very gradual settling-down of the water in the higher latitudes, a return toward the equator in the lower strata, and a very gradual rising-up again in the lower latitudes.

If the earth had no motion of rotation on its axis, this would be simply a vertical circulation without any motion either east or west. But, in consequence of the deflecting force of the earth's rotation, the water of the upper strata, in flowing from the lower latitudes toward the poles, is deflected eastward; and it retains this eastward motion until it has settled down in the higher latitudes into the lower strata, and has returned, perhaps, to the parallel of 35° or 30°.

by which time the deflecting force due to the earth's rotation—always to the right in the northern hemisphere, and the contrary in the southern—has overcome the eastward motion, and it now begins to assume a westerly component of motion. Hence, where there is an interchanging motion between the equator and the poles, the effect of the earth's rotation is torsionary, tending to give rise to an eastward motion in the higher latitudes, and a westerly one in the lower latitudes; extending, where there are no interruptions from continents, all around the globe. The relation between these must be such that the action of the former, by means of friction on the sea-bottom, shall not have any greater tendency to turn the earth eastward on its axis than that of the latter to turn it the other way: for no change in the velocity of the earth's rotation can arise from the action of forces simply in the plane of the meridian, which are the only real forces here, those arising from the earth's rotation being simply modifying influences. Since the action by means of friction upon the sea-bottom in the higher latitudes, which tends to turn the earth from west to east, is much nearer the axis of rotation than that in the lower latitudes, which tends to turn it the other way, the eastward motion in the former is more rapid than the westward one in the latter.

In the real case of nature, in which a continuous motion either east or west all around the globe is interfered with by the continents, the tendency to such motions gives rise to various deflections by the continents. For instance: in the North Atlantic the tendency to flow eastward in the middle and higher latitudes causes a slight heaping-up of the water, and a rise of surface level adjacent to the coast of Europe, and a drawing-away of the water and a depression of sea-level along the north-east coast of the United States. As the water of the upper strata, however, is thus pressed over against the coast of Europe, its surface does not assume a gradient of static equilibrium; for the water, in consequence of the raising of the sea-level on the coast of Europe, and especially of France, is disposed of in three ways: one part is deflected around to the left along the coast of Norway, around by Spitzbergen and the east coast of Greenland; another to the right, down by the Canary and Cape Verde islands in the region adjacent to the north-west coast of Africa; and a small part flows back westward under the upper strata as their water is forced eastward. The latter is small on account of the great pressure and friction on the sea-bottom, which does not have its counterpart in the upper strata.

It is important to inquire here what amount of motion of the water of the upper strata toward the pole, arising from difference of temperature between the equator and the pole, is required to cause, by means of the deflecting force of the earth's rotation, the necessary pressure toward the coast of Europe, and raising of sea-level adjacent to it, to account for the observed difference of sea-level between Brest and Marseilles, and the observed resulting currents. The gradient of the ocean's surface corresponding to any given velocity of the water in any direction, in the case of static equilibrium, may be obtained from the following little table, in which the gradients are given in feet per 100 miles, for a velocity of one mile in twenty-four hours, the ascending gradient in the northern hemisphere being always at right angles to the right of the direction of motion:—

Latitude.	Gradient.	Latitude.	Gradient.
	Feet.		Feet.
0°	0.000	50°	0.101
10	.023	60	.114
20	.045	70	.123
30	.066	80	.129
40	.085	90	.131

From this table, it is seen that a velocity of four miles per day of the water of the upper strata toward the pole, on the latitude of 45°, would cause a gradient of about 0.36 of a foot in 100 miles, or about 10 feet between New York and Brest, in case of a static equilibrium. But of course, for reasons already given, there would not be really this difference,—perhaps only about half of it; but this would be sufficient to account for the observed differences of sea-level between Brest and Marseilles, and the Gulf of Mexico and New York harbor; the surface of the ocean adjacent to the coast of France being about 25 feet above mean level, and that adjacent to New York as much below. The velocity above, of 4 miles in 24 hours, would give a very gentle and almost imperceptible current, and would not be at all greater than, as we have reason to think, it is.

We have, then, an ascending gradient from the north-east coast of the United States across to the coast of Europe, over which the water of the upper strata is impelled, until it arrives on the east side of the Atlantic, by the deflecting force arising from the earth's rotation and the poleward motion of the water of the upper strata. From the raised sea level here there is down-grade on the one hand, around by the north-west coast of Africa, across the Atlantic in the lower latitudes to the Caribbean Sea and Gulf of Mexico, and thence to the low surface-level on the west side of the Atlantic; and, on the other hand, around along the coast of Norway, and by Spitzbergen and the east coast of Greenland, to the same region of depressed sea-level; both tending to fill up the partial vacuum, as it is being continually maintained by the drawing-away of the waters, as explained above. The general descending gradient from the equator toward the pole, due to a difference of temperature, tends to decrease the gradient from the coast of France down by the north-west coast of Africa, and consequently the strength of the current; but the same increases the gradient and the strength of the current on the opposite side from the Caribbean Sea and the Gulf of Mexico. Hence the latter is greater than the former.

As a wide and gently flowing river, when it is contracted into a narrow pass, becomes a rapid stream, so the flow of the warm water from the Caribbean Sea and the Gulf to the region of depressed ocean surface adjacent to New York, being forced to pass mostly through the Strait of Florida, becomes, instead of a wide area of very gentle flow, as it would be if it were not for the West India Islands, and especially Cuba, a comparatively very narrow and rapid stream, 'a river in the midst of the ocean.' As this river of warm water flows northward, it tends, by the effect of the earth's rotation toward the right, and as the current from the east coast of Greenland flows southward it is likewise deflected to the right, toward the American coast. Hence, having very different temperatures, and being deflected to con-

trary sides, there is no tendency to mix together; but the division between the two, called the 'cold wall,' is nearly a vertical plane. This is the whole mystery of the Gulf Stream and of the cold wall.

The level of the Mediterranean Sea at Marseilles is undoubtedly a little lower than that of the Strait of Gibraltar and of the ocean generally adjacent to the north-western coast of Africa; so that the latter is about on a level with the western extreme of the Gulf of Mexico, there being a little down-grade across to the West Indies, and then a little ascending grade to the coast of Mexico to check the westward motion, and to deflect the current around toward the north. The difference, therefore, between the ocean-level at New York and Brest is probably about five feet.

There is another theory, the wind-theory, which is thought by some to explain satisfactorily all the currents of the ocean. It may be well to examine a little here the claims of this theory, and especially to consider whether it is adequate to explain the recently observed differences of sea-level. The westward component of the trade-winds, by this theory, raises the level of the Gulf of Mexico, and depresses the sea-level on the north-west coast of Africa as much; and the eastward and north-eastward motion of the air in the middle latitudes drives the water toward the coast of Europe, and so causes a depression of the sea-level on the American coast, and a raising of it on the coast of Europe. It is readily seen that this would give precisely the same system of circulation, and tend to cause the same differences of level between the Gulf of Mexico and New York harbor, and between the harbors of Brest and Marseilles, as the other theory. But it is well known that ordinary winds have very little effect in changing sea-level, except in very shallow water.

According to the Report of the chief of engineers (1876, part iii. p. 76), by the mean of all observations, the difference of mean level of Lake Ontario, at either end, with north-east, east, and south-east winds, and with south-west, west, and north-west winds, is only 0.05 of a foot, and hence the average effect of either class of winds on the surface level is less than one-third of an inch.

Again, if the trade-winds cause a raising of the sea-level in the Gulf of Mexico by a half-metre, they must depress the sea-level on the Pacific coast of Mexico about the same amount, and so there would be a difference of level of about one metre on the two sides. But by the levellings for the Nicaragua ship-canal, the elevation of the surface of Lake Nicaragua was found to be exactly 107 feet above mean tide of either ocean. Hence the trade-winds have no sensible effect in changing sea-level.

Furthermore, if the trade-winds can have so great an effect as is claimed for them, then the still stronger westerly winds, which usually prevail in the middle latitudes of the North Atlantic, should change the difference of sea-level between New York and Brest at least as much; and if so, there would have to be a considerable annual inequality in the height of sea-level; for the westerly winds are much more prevalent, and blow very much more strongly during the winter than during the summer season. There ought, therefore, to be a change of the height of sea level of more than one foot, higher in winter and lower in summer, on the east side of the Atlantic, and the reverse on the other. But no such inequality is observed on either side. Mean sea-level is two or more inches higher, on both sides, in summer than in

winter, which is evidently due to the difference of temperature of the sea-water in the two seasons, and there is no apparent effect whatever arising from an increase of the strength of the winds. The only inference from this is that the strongest winds have no sensible effect.

A continuous wind, for some time in any direction, evidently causes mere surface currents of considerable velocity; but if they could even explain the strong and deep flowing currents, such as the Gulf Stream, it is evident, from what is shown above, that they cannot account for the great differences of sea-level which have been shown to exist by recent levellings.

WM. FERREL.

Washington, Jan. 18.

Oil on troubled waters.

I do not know much about the sea, and so perhaps you will wonder the less at my expressing incredulity with reference to the reports of the extraordinary effect of 'oil on troubled waters,' to which you seem to give unqualified assent in your notes and comments of Jan. 15.

It is indeed remarkable that seamen should have overlooked this important aid to navigation, if, as you declare, its efficiency in calming the waves is as obvious as the use of the rudder in shaping a new course; for sailors are not usually slow to adopt notions favorable to the existence of prodigies and marvels.

But, if the newspaper accounts of the matter are to be believed, it strikes me that the hydrographic office has quite outdone every other politico-scientific bureau in the propagation of startling generalizations from very flimsy details. For example: one of its witnesses testifies that in 1863, when off Sydney Head, he encountered a terrific gale, followed by a tremendous sea, in which his ship was making water, and was in danger of wreck, and that he at first tried oil upon the waves by 'jerk'ing it out' over the side of the vessel, through a hole in the cork of a bottle; but finding that when employed in this way it blew about the stem of the ship, and not into the sea, he made use of 'the oil-bag,' into which he put about half a gallon, tying the neck tight, and towing it astern. After a short time, he says, "the effect was wonderful; for what was a very heavy-running and dangerous sea was reduced, by the use of the oil, into what a seaman would call 'blind rollers,' quite harmless to a ship." He asserts that in this manner he ran his half-sinking vessel from Sydney Head to Port Stephens, a distance of sixty-eight miles, in eight hours and a half, on a consumption of two gallons and a half of oil, although he considers that his way of using it was wasteful. His subsequent experiences convinced him that a ship could run in any sea with safety for twenty-four hours on a consumption of five gallons of oil.

It is hardly surprising, that, as soon as the hydrographic office began spreading such sailors' yarns as this, other captains should have felt the necessity of keeping abreast of the times in nautical science by publishing their similar experiences. Accordingly the skipper of the schooner J. B. Atkinson announces, that, on the 25th and 26th of December, his vessel was saved from utter destruction off Cape Hatteras by bags of oil, which he also towed astern; and still later, the captain of the steamer Lucy P. Miller, running between Philadelphia and Nassau, writes to

the chief hydrographic officer that he, too, was in imminent danger in a heavy gale on the 26th of December, but that, having read what the hydrographic office had said about using oil, he "placed a bag in each closet forward, and let her go south-south-east," the effect of which was that he shipped no more water.

After all this, I should not wonder if some Jack tar, a little more imaginative than the rest, should outrun all competitors by reporting to the hydrographic office that he had quelled the raging deep merely by carrying a bottle or two of oil in the ship's locker; just as Hahnemann finally found that it was not necessary actually to take his medicine, but that, if the patient only smelled of the phial in which it was contained, it accomplished the same result.

Now, I should seriously like to know whether there is any more credible evidence that oil has a quieting influence upon the ocean than the kind of trash the newspapers are publishing as coming from the hydrographic office.

C. F. Cox.

New York, Jan. 18.

[Our correspondent assumes a very grave responsibility in trying to throw discredit on the efforts of the hydrographic office to render less dangerous the very hazardous vocation of the sailor. The efficacy of the use of oil to smooth the rough waters has been known for centuries, and the seamen of all countries have been in the habit of resorting to it when the necessity has arisen, although, for the reasons given below, not as freely as would be desirable. The evidence accumulated by the hydrographic office, through its branches in the seaboard cities, is the result of the first systematic attempt ever made by any government to collect such information, and to disseminate it, in the widest possible manner, among the class most interested. Many seamen have used it with success; and most, having heard of its value ever since boyhood, have always intended to use it on occasion. It must be borne in mind, however, that there is much to be done on board a ship undergoing all the vicissitudes incident to a gale of wind; and, unless the captain has had previous experience, he is not likely to think of experimenting when there is so much to do which he knows to be necessary. Seamen, also, though given to the telling of 'yarns,' are slow to believe them, a very harsh and trying experience making this class most incredulous and conservative.]

The life-saving services of this country and Great Britain have made experiments with a view to demonstrating the usefulness of oil in quelling the surf. The results, however, have been unsatisfactory; yet this investigation led them incidentally into the subject of its usefulness off shore with most satisfactory results. The report to the superintendent of the U. S. life-saving service in 1883, of a committee appointed to examine this matter, states in conclusion, "The majority of the printed statements herewith, assuming them to be authentic, together with all verbal statements made by mariners who have used it, furnish conclusive evidence that in deep water oil has a calming effect upon a rough sea."

In an article published in the *Nineteenth century* for April, 1882, Mr. C. F. Gordon Cumming states that "it is now many years since I first endeavored to call public attention to the simple precaution." "Though the casting of oil on troubled waters has been so persistently regarded merely as a poetical

figure of speech, notes of its actual use have occasionally appeared in books of travel;" and, again, "It has been reserved for the nineteenth century to find the practical application of the observations made by Pliny eighteen hundred years ago." The correspondent's confessed want of knowledge of the sea leads him very properly to make inquiries in regard to its 'prodigies and marvels;' but his sympathy should restrain him from decrying any attempt to benefit a class which, on the whole, gets a very small share of the substantial comforts of life.—*Ed.*]

The following is a letter received at the Boston branch of the hydrographic office:—

On Nov. 28, 1885, I left Boston for London, deep with general cargo, and cattle and sheep on the upper deck. At 8.30 P.M. of Dec. 4 we were caught in a heavy storm at W. N. W., bar. 29.20. The first hour of the storm no canvass could stand it. In lat. 44° 38' and long. 48° 28' W., ship running under bare poles, the sea was then so high and dangerous. I resolved to try the use of oil, having had it brought to my notice by information on your chart. I got two common gunny-bags and a good wad of oakum wrung out in paint-oil, and hung over each quarter, just dipping in the water, also one over by the scuppers in the midships. At 10 P.M. I got the lower topsail set, and continued to run until noon next day. By the racing of the engines my engineer reported to me that he could not run much longer, as the packing of the gland of the high-pressure engine was all worn out. I then got two more farther forward with a hand in each water-closet forward, dropping oil through; by this means she kept steady on her course, engines stopped, and sailing 6 knots, while the engineer did his work comfortably. I landed the whole of my cattle alive at Deptford, and never broke any of the cattle-pens.

The use of oil I strongly recommend in an emergency; a small drip is of no use. I used one gallon per hour, and had the watch continually going round attending one bag after another.

The result you know, and I hope it will be of use to shipmasters.

KENNETH DOYLE, *Master*.

Furness line, SS. Stockholm City,
Boston, Jan. 17.

The Taconic controversy in a nutshell.

In *Science*, No. 153, Prof. N. H. Winchell, in writing under the above head, presents a very timely demurrer against the injustice done to the memory of Professor Emmons in ignoring the name 'Taconic,' and substituting 'Cambrian,' and several other designations, for pre-Potsdam formations other than Archaean.

In referring to recent studies of rocks that have been claimed as part of the Taconic by Emmons, Professor Winchell writes, "Some of the opponents of Emmons, re-enforced lately by active, younger men, revive the fossiliferous character of some of the eastern belts as new matter, adding many interesting and valuable details, and begin again to fire at the old fort long ago abandoned by Emmons, insisting that Emmons is still intrenched there (1872-85)."

I have several reasons for thinking that I have been understood to have taken a stand as part of the re-enforcement, because of my having recently published a paper on the subject mentioned, and entitled "On the occurrence of fossils in the 'Hudson

River' slates in Orange county, N.Y., and elsewhere."¹

In this paper I described the finding of Trenton fossils in slates that Emmons had always considered to be of Taconic age; and Professor Mather's² statement that the remains of 'Testacea' were found at certain localities in these states appears to have been overlooked in Emmons's latest discussion of the subject (likewise in that of Dr. Hunt³). In calling attention to the nature of these remains, and adding a new locality, with descriptions of the structure of the beds, I was only presenting bare statements of facts; but, in consideration of the Taconic theory, I employed the words 'Fossils in the Hudson River slates,' etc., rather than 'Trenton fossils in the Taconian argillite,' in my title.

It can be readily understood how isolated patches of Utica slates could extend along the Hudson valley as far south as noted by Booth;⁴ but my observations, together with those of Dale,⁵ show the occurrence of Trenton fossils in beds at several widely separated points in the slate belt (I have discovered other localities since my paper), and point to the age of the great mass of these slates as post-Potsdam. An examination of the relations at Rock Tavern and at Sugar Loaf plainly proves that the fossiliferous beds are not isolated patches, and that neither are they superficial layers enclosed in synclinal folds, nor brought to their present positions by faulting.

In this connection it may be well to state that for some time the writer has been engaged upon a very detailed study of the structure of these slates, and the associated limestones and other formations. Many paleontological and stratigraphical discoveries have been made which will solve some of the problems of their ages and relations. A portion of the results of this work will be ready for publication early in the next summer.

NELSON H. DARTON.

Brooklyn, N.Y.

The temperature of the moon.

I hope that Professor Ferrel and I have no real ground of dispute: I may at least think so, since he does not deny that he begins by speaking of a certain body endowed by hypothesis with peculiar properties; such, for instance, as imply invisibility. Professor Ferrel, as I now understand him, explains that this implication is non-essential, and merely an analytical device to explain what would take place on a certain sphere, on which (by hypothesis still) the relative radiating and absorbing powers of every part are not merely proportional for any given ray, but to be safely treated as absolutely and without restriction equal, — a sphere on which, instead of physical approximations, we have absolute truths, which, like the axioms of Euclid, can be safely pushed to their extremest consequences.

This sphere it is my complaint that Professor Ferrel identifies with the moon, though it also seems to be a homogeneous body, not a world of irregular surface and structure; a body freed from changes of temperature, and which (unless infinitely conductible) would appear to need, not to alter its distance from the sun or rotate on its axis, — an absolutely

airless body; and so on, through a really endless list of limitations, which we should find, on scrutiny, latent in his premises. *Under these limitations*, I do not dispute any of his conclusions; nor, when I say that no actual body in nature does exist under them, do I at all deny his right to consider one which by hypothesis shall do so, nor the interest of such an inquiry. I only call the reader's attention to the undoubted fact that the real moon exists under quite other ones. While I do not for a moment admit that the temperature of the real moon is independent of the amount of heat which it rejects by reflection, I can readily agree that it might be quite immaterial to the temperature of this hypothetical moon. I have no disposition to treat such an hypothesis as idle: I acknowledge its interest, and, I may add, its utility, if employed under clearly recognized limitations.

I recognize with respect the accuracy of the logical process always at Professor Ferrel's command; but, I repeat, the more accurate it is, the more certain it is to deduce only such conclusions as are implicitly contained in its premises.

Though he himself refers in part to these limitations at the outset, the general reader may certainly require to be reminded that they are not embraced in Professor Ferrel's conclusions, which may well be deduced from commonly made assumptions, by correct reasoning, as to a hypothetical moon, and yet not apply without limitation to the real one which we see waxing and waning in the sky. This is all I have to say, and I leave to Professor Ferrel the last word in this friendly controversy if he chooses to add it.

S. P. LANGLEY.

Allegheny observatory, Jan. 12.

Demand for good maps.

I am very glad that you have taken upon yourself to criticise our maps and the map-makers' methods, and sincerely hope that you may succeed in so stirring up the publishers that they will feel compelled to abandon the habit of servilely copying ancient, and oftentimes obsolete examples. I have been seriously inconvenienced at times, particularly when giving instruction in geography, by the outrageous carelessness, not to say gross ignorance, displayed by our leading cartographical institutions.

I heartily concur in what Mr. C. H. Leete says concerning the German maps. We are far indeed from their standard. Why is it? It is no exaggeration to say that the cheap German school-atlas, to which Mr. Leete refers, is much more reliable, and more nearly up to date, even in the geography of the United States of America, than the most expensive of our home productions.

Some years ago the travelling agent of one of our leading map-publishing houses called upon me, and insisted upon showing me their latest atlas, revised and corrected to date. I gave him every opportunity to explain the superior excellence of his wares, and, after he had had his say for over half an hour, I showed him that most of his maps were exact copies of those published from five to twenty-five years previously, the only apparent change being in the shades and elaboration of colors. Why, actually, though this was scarcely five years ago, the map of New York city showed the 'Crystal Palace'! Even where details appeared to fill in former blanks, more than one-third were mere guesses, and about as good

¹ *Amer. journ. sc.* (3d ser.), xxx. p. 452, 1885.

² Final report, 1843, p. 369.

³ The Taconic question, *Trans. Roy. soc. Canada*, vol. i.

⁴ *Amer. journ. sc.* (3d ser.), xxvi. p. 380, 1883.

⁵ *Ibid.*, xvii. p. 57, 1879.

guesses as the 'Golden City,' Colorado, to which you called attention some time ago.

J. KING GOODRICH.
Smithson. inst., Washington, Jan. 13.

Cliff-picture in Colorado.

The accompanying print is from a photograph of a remarkable formation which may be deemed worthy of mention. The original photographic print was sent to the military academy, about twelve years ago, by Capt. (then Lieut.) George S. Anderson, sixth U. S. cavalry. I have lately obtained from Captain Anderson the following statement in regard to the object. His statement is from memory, after the lapse of a dozen years; but it is not probable that there is any material error in it, as he went to considerable trouble to secure the photograph. The natural picture is on the face of the sandstone cliff forming the west bluff of the Purgatoire River, Colorado, twenty miles from its mouth, and twenty-five miles from Fort Lyons. The total height of the cliff at the point is about seventy feet above the bed of the river. The picture is about thirty-five feet above the stream, with twenty-five feet of vertical cliff above it. The talus of the cliff extends up about thirty feet, so that there are about five feet of vertical wall between the picture and the loose rock below.



The extreme length of the picture is at least seven feet. The cliff is composed of brownish-red sandstone: the picture at the surface is of a much darker color, which color gradually passes into the uniform color of the rock, at a distance of 2½" or 3" from surface, as shown by detachable fragments. Copies of the photograph were sent, at the time it was taken, to Prof. Joseph Henry, Professor Dana, and to Darwin. Professor Henry asked, "Can it be any thing else than a work of Indian art?" Professor Dana thought the color due to iron stains, and the outline accidental. Darwin hesitated to express an opinion, but dissented from Professor Dana. Colonel Kendrick, formerly professor at the military academy, expressed the same opinion as did Professor Dana.

The figure is remarkably distinct and well defined for the result of accident; but, if Professor Henry's idea be rejected, there seems no other explanation.

S. E. TILLMAN.

West Point, N.Y.

The English sparrow.

A European ornithological journal recently contained the following testimony in regard to the sparrow (*Pyrgita domestica*), from the pen of Dr. Schleh, professor of agriculture at the College of agriculture, Herford, Germany. Dr. Schleh has paid a great deal of attention to this matter, and believes the sparrow a pest on the continent, voluminous evidence of which he is said to have brought forward in his small treatise entitled 'Der nutze und schaden des sperlings (*P. domestica*) im haushalte der natur.'

By examining the crops of a great number of nestling sparrows sent to him from different parts of the country, he found that young sparrows, while in the nest and for a week after having left it, subsist entirely on insects, grubs, etc. Two weeks after leaving the nest, their food still consists of 43 per cent of animal food; a week later of 31 per cent, and after that age of only 19 per cent, of animal ingredients. But as soon as they become independent of their parents, they prefer seeds, and subsist almost entirely on grain, fruit, and the buds of trees. Dr. Schleh, however, mentions some interesting instances regarding some specimens which seemed to have a peculiar taste for the seeds of weeds which often become a great plague to the agriculturist. In one crop he found the considerable number of 321 whole seeds of *Stellaria media* (Vill.), in another 43 seeds of *Atriplex patulum* (L.), in a third 66 seeds of *Setaria verticillata*. Some individuals also have a special liking for certain insects. Thus he found in one crop 90 specimens of *Haltica affinis* (Gyll.); four other sparrows had eaten almost nothing else but a certain kind of beetle, *Anisoplia fruticola* (F.).

ERNEST INGERSOLL.

Equality in ability of the young of the human species.

The review of a recent work on geometry, in *Science*, Jan. 1, is very justly criticised by W. R. in the number for Jan. 8.

Nothing is more fallacious than that ancestors have much to do with natural endowments: environment has much, and pre-natal influences probably most of all, in determining mental qualities. Physical traits are to some extent traceable to ancestry; but the whole history of the race, and of our country in particular, is a refutation of the much studied hereditary genius, or transmitted mental quality.

Even the writer's comparison is unfortunate. Nothing seems more like chance than the development of a race-horse. When the truth is known of our most celebrated mile-in-two-fourteen trotters, they will be found to have been picked up here and there from the peddler's cart or from the farm. Their qualities accidentally discovered, and fictitious pedigrees made up for them, they have never left a racing progeny behind them.

I fully agree with N. E. in saying, "Better assume that the young are born equal in ability, and in their early training . . . give them an equal chance to develop into mechanics, store-keepers, artists, farmers, or lawyers;" but by all means give them a chance to follow the bent of their intellect as soon as they are old enough to differentiate it, as, for instance, in their college courses.

P. J. FARNSWORTH.

Clinton, Io., Jan. 12.

SCIENCE.—SUPPLEMENT.

FRIDAY, JANUARY 22, 1886.

THE COLLAPSE OF THE THEOSOPHISTS.

THE greater part of the last number of the Proceedings of the Society for psychical research¹ is taken up with the report of the committee appointed to investigate the famous Theosophical society.

For the information of those of our readers who have not followed the history of this society, a brief explanation will be necessary. The Theosophical society was formed in New York in 1875, by Colonel Olcott and Madame Blavatsky, for, it was asserted, philanthropic and literary purposes. Three years afterwards its seat of operations was removed to India, and among the better class of natives it seems to have gained not a few followers.

The evidence adduced before this committee of investigation—which included Prof. Henry Sidgwick and Messrs. F. W. H. Myers and Edmund Gurney—claims the existence in Thibet of a brotherhood whose members have acquired a power over nature which enables them to perform wonders beyond the reach of ordinary men. Madame Blavatsky asserts herself a *chela*, or disciple of this brotherhood, the members of which are spoken of as mahatmas, who are said to have taken a great interest in the Theosophical society, and to have performed many marvels in connection with it. They are said to be able to cause apparitions of themselves in places where their bodies are not, to communicate intelligently with those whom they thus visit, and to perceive what is going on where their phantasm appears. This phantasmal appearance the theosophists denominate the ‘astral form.’ The theosophists also brought forward evidence in support of another class of phenomena, including the transportation, even through solid matter, of ponderable objects, including letters, and of what the theosophists regard as their duplication, together with what is called ‘precipitation’ of handwriting and drawings on previously blank paper.

Because of the peculiar nature of the evidence, and the great improbability of the production of the alleged phenomena, it was decided to send a trusted observer to India, who should make a thorough examination of the persons involved, and

of places in which these remarkable occurrences took place. Therefore, a member of the committee, Mr. R. Hodgson, B.A., of St. John’s college, Cambridge, proceeded to India in December, 1884, and carried on his investigations for three months.

On hearing Mr. Hodgson’s report, which is appended to the report of the committee, and carefully weighing all the evidence before them, the committee unanimously reports:—

“1. She [Madame Blavatsky] has been engaged in a long-continued combination with other persons to produce by ordinary means a series of apparent marvels for the support of the theosophic movement.

“2. That, in particular, the shrine at Adyar, through which letters purporting to come from mahatmas were received, was elaborately arranged with a view to the secret insertion of letters and other objects through a sliding panel at the back, and regularly used for the purpose by Madame Blavatsky or her agents.

“3. That there is consequently a very strong general presumption that all the marvellous narratives put forward as evidence of the existence and occult power of the mahatmas are to be explained as due either (a) to deliberate deception carried out by or at the instigation of Madame Blavatsky, or (b) to spontaneous illusion, or hallucination, or unconscious misrepresentation or invention on the part of the witnesses.”

And, as the committee regards it as a waste of time to further prolong the investigation, many sober-minded readers will regard it as a foolish waste, that so much time has been already spent in the matter. But it must be recollected that this society was gaining ground and support, and was imposing on thousands of impressionable and credulous people. To them it is a real act of benevolence that this bubble has been pricked once and for all, and in a scientific way. As to Madame Blavatsky, a mere reading of the pages of evidence compels an agreement with the committee, who say, in conclusion, “We regard her neither as the mouthpiece of hidden seers nor as a mere vulgar adventuress: we think she has achieved a title to permanent remembrance as one of the most accomplished, ingenious, and interesting impostors in history.”

In addition to the report of this committee, of which the preceding is a summary, this volume of

¹ *Proceedings of the Society for psychical research*, part ix., December, 1885. London, Trübner, 1885. 8s.

the Proceedings contains an interesting essay on 'Some higher aspects of mesmerism,' by Messrs. F. W. H. Myers and Edmund Gurney, who treat of the existence, limits, and varieties of mesmerism as a therapeutical agency; and a further report on 'Thought-transference,' with numerous statistics and diagrams, by Malcolm Guthrie, J.P. While many of Mr. Guthrie's experiments are novel, and as a rule more difficult than usual, yet they are of the same general character as those with which those who have followed the progress of the societies for psychical research, both in England and in this country, are already familiar.

NICHOLAS MURRAY BUTLER.

GIANTS AND DWARFS.

THE above title is prefixed to a series of articles¹ recently published, but is, however, somewhat misleading. What is attempted is, not the consideration of the causes and consequences of abnormal deviations in height in the human species, but a presentation of the differences resulting from the absolute size of an animal, — a sort of 'animal mechanics,' which, in the author's opinion, is to become an important chapter of morphological science. The speculations presented are not without some value and considerable ingenuity: but they are characterized by a passion for reducing every thing to mechanical terms in a way which does not fit biological facts; by a peculiar anthropomorphic point of view, which gauges the actions of animals as though the animals were men; and by an avoidance of evolutionary principles, which one would think would be especially important in this connection. Perhaps it will not be altogether without interest to sketch very briefly the author's methods and his conclusions.

If a body is ten times smaller in one dimension, say in height, than another, and is to retain the same shape as the first, all linear dimensions will be reduced to 1-10, all surface dimensions to 1-100, and all solid dimensions to 1-1000, of their size in the original body. For brevity's sake, we will call an animal of average size a meso-animal (*Me*); an animal 1-10 as large will be a micro-animal (*Mi*); one 10 times as large, a macro-animal (*Ma*). Keeping these statements in mind, we will review the differences which would be caused in the several vital systems by a reduction of an animal to 1-10 its size.

Beginning with the skeleton. We will measure the strength of a bone by the multiple of the weight of the animal necessary to crush it. Now, as the strength of a beam (the bone) varies (1) as

the square of the thickness, (2) directly as the breadth, (3) inversely with the length, if the bone is reduced 1-10 in length, breadth, and thickness, it can carry 1-100 of its former weight, while it has been reduced 1-1000 in volume; i.e., it is relatively 10 times stronger than the large bone. If the tooth of a meso-dog can just bear the dog's weight, then the tooth of a micro-dog can carry 10 micro-dogs; or, if it is to carry its own weight, it can become 1-5 smaller in cross-section. The smaller an animal, the more tender, weak, and soft may its skeleton be to satisfy its needs. This principle accounts for the presence of teeth in micro-animals of such a shape as would be useless in meso-animals.

Next the muscles. If 1,000 micro-animals were to jump against one meso-animal, each *Mi* would jump as high as the *Me*; for relatively equal muscles, with a single contraction, do relatively equal work. But altogether they will do absolutely as much work as the *Me*. The jump will depend on the ratio of the muscular system available for jumping-purposes to the whole body. A thousand small muscles will lift 10 times as much as one muscle 1,000 times its weight. Moreover, the small muscles would contract quicker than the large one. If one meso-man can throw stones the size of his fist for a distance of 50 of his own steps in 1 second, then a micro-man could throw stones the size of his fist for a distance of 500 of his own steps in 1-10 of a second. A micro-girl would knit a stocking of an equal number of meshes in 1-10 the time required by a meso-girl.

Again, take walking. The vibration of the leg of the micro-man will take about $\frac{1}{10}$ ($\frac{1}{\sqrt{10}}$) of the vibration-time of the leg of the meso-man. The small man will walk very rapidly; but, as fatigue depends on the number of contractions, he will tire easily, will be out of breath soon, and will have covered very little distance. If we reduced our man by 1-100, the walking would be so rapid as to give forth a low tone; and if to 1-1000, the vibration of his legs would give a shrill note. Hand-shaking would take the form of a gentle chirp. The micro-man is evidently at a great disadvantage in walking: this can only be remedied by giving him different locomotive organs and a different mode of locomotion. If we give him very long extra legs on each side, and put his body between them, he will be able to overcome the inertia of his body much more readily; he will be able to resist small shocks without shifting to a great extent the centre of gravity; and he will acquire a hopping gait, which is much better suited to small animals. In short, he will approximate the arthropod, in

¹ K. Fuchs, *Kosmos*, 1885, ii., Nos. 3, 4, 5.

particular the insect type. This proposition that the arthropod form is best adapted for small animals, and the mammalian form for large ones, is one of the points insisted upon throughout.

Amongst other differences are the following: The nervous impulses would be conducted to the centre in 1-10 the time, and his reflex movements and reactions would be quicker. A water-rat can see the blaze of a gun and dip under the water before the shot has time to reach it. With regard to warmth, it is shown that the body surface of a small animal gives off more heat proportionately than that of a large one: hence small birds have a thick covering, or, again, the small animals become cold-blooded.

But we will leave this part of the subject to consider what may be called a micro-psychology. Some rather curious conclusions are drawn with regard to the sense of sight. While the same amount of light will affect the retina of the meso- and the micro-man, nevertheless, owing to the difference in convergence of the two eyes (upon which depends the inference of distance), the micro-man will judge things to be smaller and nearer than the meso-man. His horizon would be much more limited, and in seeking an object he would be less apt to find it.

As to hearing. As micro-animals live in a condition where a constant noise is present, they acquire special organs for making loud noises, such as are found on the legs of some insects; while, of course, their hearing is less available to them than in the case of larger animals.

The general principle with regard to the nervous system is this: as the amount of nervous matter necessary to the needs of a small animal is proportionately much smaller than in a larger animal, such nervous matter becomes available for other purposes, and thus very fine sensibility to small physical variations, and the development of peculiar sense-organs, become possible. Eyes and ears are multiplied, touch-organs of various kinds become numerous, and there is more room for variability than in higher animals.

This theory makes it probable that small animals are endowed with a sensibility for fine discriminations of temperature, barometric pressure, moisture, and so forth, which is unknown to us; and thus we account for the observation that animals take cognizance of the approach of a storm before man does.

With regard to psychic life, the following statements will be of importance: the micro-animal procures its food for a given period with less trouble than a meso-animal, it builds its house in a much shorter time, it foresees natural changes

much better, and its movements are quicker. The result will be far-reaching forethought by means of house-building and harvesting instincts. Any act desirable for the moment, the meso-animal will be apt to neglect on account of the bother of doing it. A man sees a spot on his writing-desk for years, and never cleans it up; he decides to learn by heart a table of constants which has to be looked up with trouble each time, but never does it. This dread of labor causes most kinds of neglect. But with the micro-animal the act follows the word; there is no trouble, and thus much annoyance and danger to health are avoided. In the case of approaching danger, say of a storm, a meso- and a micro-animal will act very differently. The meso-animal recognizes the danger only when it is near, is flurried and frightened, has no time to build a shelter, and must seek a chance one. The micro-animal knows that the danger is not very near, that he has ample time to build a shelter, and need not trust to chance. And thus we see why many of the smaller animals prefer to build a new nest, to protecting or finding an old one, it is so readily done. By arguments which it would be difficult to reproduce, the conclusion is reached that the train of thought of this micro-animal is related to that of the meso-animal somewhat as a minuet to an opera of Wagner's, or a frieze pattern to a painting by Kaulbach; also that his conceptions would tend to be mathematical and regular. But in general it may be said that in psychic life the meso-man would have the advantage of the micro-man.

This very partial account of these speculations will, perhaps, serve to show their general tendency. They certainly belong to a class of thinking which is rather foreign to recent thought, but bring with them a suggestiveness which makes the problem discussed a very interesting one. The most serious objection is that very little attempt is made to show that the theory fits the facts (which might easily have been done), and more attention is paid to select facts that seem to fit the theory. As particularly worthy of consideration, may be noted the argument that when proportionately less of a certain tissue is needed for actual sustenance of the animal, more of it becomes disposable, and is subject to variation. It would seem possible that some valuable facts might be attained by a careful experimental study of the problems suggested by these theoretical considerations; and while they will not be sufficient, as they have been to our author, to rear upon them a whole physiology, a whole zoölogy, and a whole psychology, they will do a unique service to science.

THE RACES OF BRITAIN.

It is the praiseworthy custom of the Welsh national Eisteddfod to offer prizes for essays upon some topic relating to the ancient national life. This has produced excellent results in many directions, especially in the encouragement thus bestowed upon ethnological studies. Among the substantial fruits of such competitions are to be reckoned an able study by Mr. Luke Owen Pike on 'The English and their origin,' and Dr. Thomas Nicholas's valuable treatise upon 'The pedigree of the English people,' which in 1878 had reached its fifth edition. To neither of these learned works, however, was the great prize awarded. It was bestowed upon an essay presented by Dr. Beddoe, the late president of the Anthropological society of London, which has just been published, in an expanded form, in the volume now before us.

Differing from previous works, like those just alluded to, and Professor Rhys's 'Celtic Britain,' which are principally based upon historical and linguistic investigations, this is made up, to a large extent, of tables, maps, and plates compiled from the author's personal observations on color and stature, conducted on a large scale.

Dr. Beddoe's system is founded essentially upon the belief that permanence of color of the hair and eyes is most indicative of racial differences. The opposite opinion seems to have prevailed, ever since the days of Galen and of Celsus down to quite a recent date, that the color of the hair depends simply upon temperature and latitude. Our author's method separates eyes into three sorts, — light, intermediate or neutral, and dark. This distinction is founded as much upon shade as color. They are further subdivided into five classes, in accordance with the color of the associated hair; viz., red, fair, brown, dark, and black. Thus is derived, as a ready means of comparing the colors of two peoples or localities, the 'index of nigrescence,' by "taking 100 of each, and subtracting the number of the red- and the fair-haired persons from that of the dark-haired, together with twice the black-haired." This gives a number which compendiously represents this tendency. The black is doubled in order "to give its proper value to the greater tendency to melanosity shown thereby; while brown (chestnut) is regarded as neutral." This method Dr. Beddoe believes to be preferable to that of Virchow, which notes only the percentages of the pure blond type (blue eyes and fair hair) and of the pure brunette type (brown eyes and dark hair), and pays but little attention to other

combinations, which are regarded as results of crossing.

As a striking example of the great value of the color of the hair as a test of race, he instances one of the most distinct anthropological frontiers of Europe, — a real ethnic division along the line that separates the Flemish tongue, which represents a German stock, on the north, and the Walloon, descending from an ancient Belgic race, on the south. The difference in the physiognomy of the two peoples is very marked; but such tests as head-measurements and stature fail, while that of the color of the hair everywhere holds good. So, too, as proving that the color of the hair does not depend upon latitude and temperature, he brings forward the example of the occurrence among the dark-haired Italian race of two centres of comparative fairness, — one in the north-western part of the valley of the Po, the other in the region lying between Terracina and Naples.

But Dr. Beddoe had by no means confined his attention to observations upon the hair and the eyes. In the absence of "sufficient osseous material in the museums for determining the form and size of the skull," he has measured a considerable number of living British heads. He gives an amusing account of the way in which he obtained a series of head-measurements in Kerry, without running the risk of fatiguing or irritating the subjects. The people there have large heads, but are of low intelligence, with a great deal of cunning and suspicion. The travelling party consisted of four, and, "whenever a likely little squad of natives was encountered, the two archeologists got up a dispute about the relative size and shape of their own heads, which I was called in to settle with the calipers. The unsuspecting Irishmen usually entered keenly into the debate, and, before the little drama had been finished, were equally betting on the sizes of their own heads, and begging to have their wagers determined in the same manner."

So far as concerns the survival of the prehistoric races in Great Britain, Dr. Beddoe accepts the probability of Boyd Dawkins's theory that the paleolithic people were the ancestors, or at least the near relations, of certain still existing Mongoloid races, particularly of the Eskimo. In this opinion, however, he is opposed by the eminent Hunterian lecturer, Professor Flower, who, in his president's address, delivered last January before the Anthropological institute of Great Britain, argued that the Eskimo are probably of comparatively late origin, on the ground of their being such an intensely specialized race. But our author thinks he has sufficient ground for assuming the existence of traces of some Mongoloid race in the modern population of Wales and the west of England. He in-

The races of Britain: a contribution to the anthropology of western Europe. By JOHN BEDDOE, M.D., F.R.S. Bristol, Arrowsmith; London, Trübner, 1885. 8°.

stances in particular the examples he has noted of the oblique or Chinese eye, and of prognathism, or prominence of the jaws. The latter peculiarity, by itself, would not be of much value if it were not for the great similarity in other respects that exists among the individuals in whom it is manifested. But prognathism by no means implies a low type of humanity, and it is remarked by our author that eloquence, or at least readiness of speech, seems to be a general characteristic of it.

For the neolithic period, while accepting in a broad way Thurnam's formula, 'Long barrows, long heads; round barrows, round heads,' Dr. Beddoe cannot allow that this represents accurately the character of the entire population. He believes that the distinctive practice of dolmen-building was established in Britain by a pure long-headed race, while the broad-headed people were the introducers of bronze. "Whencesoever they came, the men of the British bronze race were richly endowed physically. They were, as a rule, tall and stalwart; their brains were large, and their features, if somewhat harsh and coarse, must have been manly and commanding." It has been objected to this type, that the great development of the brows, and the transverse furrow on the forehead above, are shared by the Australian and other savage races. But it is well established that such points of likeness as these to the anthropoid apes are distributed variously among the different races of mankind, and that no one of them, taken by itself, implies intellectual or moral inferiority. "Certainly," says Dr. Beddoe, "the British bronze type is found frequently—I should say with disproportionate frequency—among our best as well as our ablest and strongest men."

But at the bronze period the mass of the population cannot be regarded as belonging to this type. Their skulls present a shape intermediate between those of the long barrows, and those of the round barrows,—a form for which Wilson has proposed the name of 'pear-shaped,' and our author the one, not very satisfactory to himself, of 'coffin-shaped.' This type may be the result of a partial fusion of the two races, or it may have been imported, already made, by the very numerous invaders from Belgic Gaul. It has usually been styled the Keltic type, but Broca thinks that the name of Kelt ought to be restricted to the race that predominated in old Keltic Gaul, from Bretagne to Savoy. Their short, thick-set figures, and large, broad heads, are very different from the ancient British type, whose general distribution throughout the three kingdoms tells strongly against its being a late importation.

Such was the population of Britain at the time of the Roman conquest, composed of several strata,

unequally distributed, of a Keltic-speaking race, some Bryothonic, others Gaelic, in dialect. This ancient British race belonged to the tall, blond stock of northern Europe, rather than to Broca's Keltic race; and they probably greatly resembled in appearance the provincials carved upon the sarcophagus of the Roman prefect Jovinus,—now preserved in the Museum of the Hôtel de Ville, at Reims,—who are conspicuously different in features from the modern Germans. This race was superposed upon a foundation principally made up of the dolichocephalic dark race of southern Europe, the so-called Iberian, which is still strongly represented in the north of Scotland and in Ireland; but no Germans, to be recognized as such by speech as well as person, had probably as yet entered Britain.

The Roman conquest, however, had no material effect in changing the character of the population. Far different was it with the Anglo-Saxon invasions that followed upon its abandonment by the Romans. The most important chapter in the volume is naturally devoted to a careful review of the various theories as to the origin of the different invading tribes, and to a thorough study of the evidence of all kinds that might tend to shed light upon the process of 'the making of England,'—ethnological and linguistic, as well as that derived from laws and social institutions. We have space to touch, and that only in the briefest manner, upon one or two of the points discussed.

Our author's researches are quite in accord with the conclusions reached by Senator Hoar in a paper read last spring before the American antiquarian society, in regard to the origin of the Yankee of caricature, the typical Uncle Sam, and Brother Jonathan, "with his long, loosely-set limbs, his sharp nose and chin, his high cheek-bones, his narrow shoulders and high head." Dr. Beddoe paints this Yankee portrait to the life, when he is describing the true Frisian type, to be seen in the people dwelling around the Zuyder Zee, who are very different in their appearance from their neighbors the Hollanders. He proves that differences existed, physical as well as dialectic, between the ancient Frisians and the Saxons; and he shows that the county of Kent was the first to be invaded by the Frisians and their neighbors the Jutes. So the main object of Senator Hoar's paper is to show the obligations of New England to Kent for much of its laws and social institutions, and the strong physical resemblance of the people of the two regions. Dr. Beddoe also brings out the notable likeness between the people of Boston, in Lincolnshire, and the frequenters of the Antwerp market. In no considerable town in England is the index of nigrescence so low. In one

particular, however, Dr. Beddoe differs from Senator Hoar; that is, in respect to the origin of the custom of gavelkind, by which the land of the father descends to all his sons in equal portions, — a custom adopted by our ancestors from the usage of Kent, and which has had a most important effect upon our history in fostering democratic institutions. Our author believes that this institution was derived from the Kymric branch of the ancient Britons, and not the Germans, and that the term can be best explained by the Welsh language.

Great differences of opinion prevail among recent writers as to the consequences of the Anglo-Saxon conquest of England, hinging mainly upon the degree of credibility attached by them to the statements of the old British chronicler, Gildas. Some hold with Freeman and Green that the ancient race was mostly exterminated; while Nicholas, and the Keltic school in general, are equally convinced that the British element predominates in the modern English people. Our author's conclusions upon this interesting subject may be summed up as follows: About the middle of the fifth century certain German tribes, invading the country, settled some districts almost exclusively, making serfs of some portion of the prior population, and forcing the remainder to the west and the south. They uprooted Christianity, and changed to a great degree the local nomenclature. But they adopted, or allowed to remain, many usages relating to the land, and they intermarried largely with the native women; so that their descendants exhibit changes in physical type which approximate them somewhat to the original inhabitants. In language the most important and necessary words, particularly among the verbs, are Teutonic: so are most of the grammatical forms and rules; and so, also, is the pronunciation.

The Danes, in the latter part of the ninth century, by their invasions, gave a strong Scandinavian tinge to the eastern counties of England, and made themselves exclusive masters of the islands around Scotland: in other parts of the country their influence is not marked.

But the Norman conquest, although it did not at once introduce any very large accession to the population, undoubtedly produced the type that is still the prevailing one among the upper classes of England. Our author finds, by an examination of the color-tints of portraits of the nobility, a prevalence of dark hues, even more marked in the sixteenth and seventeenth centuries than in the nineteenth. The severity of the conquest was chiefly felt in Yorkshire and parts of Lancashire, where the Anglo-Danish population was nearly destroyed. In other parts of the country no permanent change in the physical type or racial ele-

ments seems to have resulted from it. In this branch of his inquiries, Dr. Beddoe has drawn, principally from Domesday book and other mediæval records, interesting and useful inferences, which we regret not to be able to quote.

We will conclude by calling especial attention to three exceedingly well executed plates, in which are represented living faces, which, in the judgment of our author, reproduce the various types of 'the races of Britain.' His remark about 'the singular beauty of the women of Devonshire' seems fully warranted. H. W. H.

THE CAUSATION OF PULMONARY CONSUMPTION.

SCARCELY four years have elapsed since the important discovery of the tubercle-bacillus by Koch was announced. Many then thought that the key to the various problems of pulmonary consumption was close at hand, if not in our actual possession. Certainly therefrom a new impetus has been received in the study of these problems, — an impetus that may eventually bring about their solution; but so far this discovery has added but little to our actual knowledge of the causation of this most insidious disease.

This bacillus is readily and definitely distinguished from other allied micro-organisms. It seems to be present in tubercles wherever found, and is usually apparent in the sputum of consumptives; in some few cases it is believed to have been detected in the sputum when no signs of the disease were discovered; and other cases are known where the most careful examinations have failed to detect them, though tubercles were unquestionably present. Still the evidence so far is only negative. We may, without doing violence to the facts, assume that the bacillus Kochi is a constant accompaniment of tuberculous disease. They are remarkable for their vitality: decomposed or even dried sputum containing them retains all the powers of the fresh microbe, even after months have elapsed. Inoculated into the tissue of animals, either in the fresh state or after cultivation, they almost invariably produce tuberculous disease, though never the ordinary chronic consumption, but quick consumption, or miliary tuberculosis, which is held to be distinct in its nature. From these facts the conclusion would seem self-evident that floating particles of dried sputa, or at least when freshly thrown off from the diseased subject, might easily enter the lungs of healthy persons, and reproduce the disease. Unfortunately clinical evidence does not support this *a priori* deduction. Recent observations demonstrate that food impregnated with tubercu-

lous matter will produce corresponding disease in the intestine and other abdominal viscera. A number of dogs, subjected for several weeks to an atmosphere surcharged with particles of sputa, became tuberculous, but the evidence is not convincing.

The possibility of tubercular inoculation has been known for years. To Koch is due the credit of discovering wherein the peculiar agency consisted.

The contagiousness of pulmonary consumption has been believed for more than a century, and still is accepted by many physicians. Dr. Hermann Brehmer, upon whose extensive work¹ the present article is based, warmly contests these views, and, it must be admitted, with ability. He, in brief, endeavors to prove that pulmonary chronic consumption is never produced by the bacilli, and is neither contagious, nor, strictly speaking, hereditary. As the director for more than thirty years, of a private institution for the treatment of consumptives, he has been able to study nearly twelve thousand cases, chiefly drawn from the better classes. Certainly conclusions based upon such ample clinical material are entitled to our consideration.

Though some adherents of the bacilli theory of contagion have believed that these organisms are directly hereditary, lying latent for a longer or shorter period, to finally take on activity, yet such a view seems wholly improbable, if not absurd. Thus it is apparent, in what is considered hereditary consumption, that that which is entailed upon the offspring of consumptive parents is not the disease itself, but merely the disposition to the disease,—the consumptive habitus. If such a predisposition exist, as it unquestionably does, wherein does the true causation lie? Not in the bacilli, for they merely find a soil already prepared for their reception, and isolation does not appear to affect the chances of such predisposed persons becoming diseased. A sound, healthy person never becomes infected by the bacilli, at least never in the form of chronic pulmonary consumption, and the possibility in any other is not yet proven. It is only those in whom a predisposition exists—a consumptive habitus—who acquire the disease. What, then, is the true causation of the ordinary phthisis? This the author endeavors to show.

He has shown from the researches of Rokitsansky, and his own, that the lungs of consumptives are abnormally large, and the heart and abdominal viscera are abnormally small. Thus the lungs do

not receive their due amount of nourishment, and become the foci of disease, where the bacilli readily and easily find a lodging-place. This view may appear startling, yet it seems well sustained. The flat-breasted person of consumptive tendency has the lungs, not small, as is generally supposed, but elongated and large; the heart not merely atrophied, but actually lessened in capacity and power. Thus the relation between the normal heart and lung is about one to six; but in many consumptives so great a discrepancy as one to twelve may exist. The relation between the lungs and heart may consist not only in the former being too large, or the latter too small, but both may be actually normal so far as size is concerned, and the evil be found in abnormally small pulmonary arteries. Not only does the heart show physical incapacity, but it is functionally weakened, palpitation always existing to a greater or less degree in consumptives. Whatever may be the exact relation between these organs, the result is invariably the same,—deficient nutrition to the tissue of the lungs. Rarely are the abdominal viscera enlarged, and almost constantly it is found that consumptives have never been hearty eaters. A person with large breast, and its accompanying small lungs, an enlarged and powerful heart, well-developed abdominal viscera, and a hearty appetite, rarely, if ever, becomes consumptive.

Here, then, is the ultimate cause of the disease,—impaired nutrition. This impaired nutrition may be the resultant of various antecedent causes. First, and most important of all, is that due to heredity or prenatal life. Instances are too numerous to require argument, that acquired peculiarities may be and are transmitted to offspring. Impaired vitality, from whatever cause it may be due, re-appears often in the child. When such impaired vitality consists in the predisposing abnormal correlation of lungs, heart, and viscera, the fuel is prepared that only needs the match to start into active flame. The question here is of the greatest moment,—Were the tubercle-bacillus no longer in existence, would tuberculous disease become extinct?

A predisposing cause of but little less importance is that of the exhausted vitality in the mother, due to too frequently repeated gestation,—a cause that not only affects children of later births, but retro-acts strongly upon the mother. Thus it is that the later descendants of large and numerous families are more disposed to consumption. Again: lack of nutrition in childhood, whereby the healthy and normal development of the alimentary and arterial systems is retarded, produces a like disposition.

Injuries to the lung, in some instances, have

¹ *Die aetiologie der chronischen lungenschwindsucht, vom standpunkt der klinischen erfahrung.* Von HERMANN BREHMER, sen. Berlin, Hirschwald, 1885. 8°.

been thought to be an exciting cause; but such cases are due, the author believes, to the partial stagnation of the blood in the lung. In such rare cases where the disease first appears in the right lung, the author believes it to be owing to some malformation or aneurism, whereby this lung receives a less quantity of blood than the left.

Dr. Brehmer gives a history of five hundred cases in full,—cases in the offspring of non-consumptive ancestry, of those suffering under scrofulous or allied evils, and cases due to heredity. Other interesting results are perceived from the study of these cases. An unquestionable interrelationship appears between consumption, mental derangement, epilepsy, and deaf-mutism. The researches of Professor Bell upon deaf-mutism have, the present writer believes, substantiated the relationship of this last defect with other defects, and also show its heredity. May not all these proceed from the same general cause,—the transmission from parent to child of abnormal or deficient organs, which are ultimately due to impaired nutrition or unfavorable environment? That such effects do not follow deprivation alone, is apparent. Too great culture or luxurious habits certainly seem to be exciting causes. How much they are owing to nervous influence is a problem of interest. It is a well-established fact that wild animals kept in confinement are especially liable to phthisis. The most highly bred strains of domestic stock are likewise prone to tuberculous disease.

That consumption is contagious in the ordinary sense of the word, the author emphatically denies. It is true that the bacilli are rarely found in the atmosphere, except in large hospitals, where many cases of the disease are treated; but the author contends that a person not predisposed may expose himself with the utmost impunity to the contagia without becoming infected. As an evidence, is adduced the fact that in Göbersberg, during the last forty years, many thousand cases have been treated; nevertheless, the mortality from this cause among the inhabitants of the place has actually decreased by about fifty per cent from that of the preceding forty years. A century ago, in Naples and in Portugal, legal enactments placed this disease under the most rigorous ban. It was looked upon and treated as one of the worst pestilential diseases, and every thing connected with it pronounced unclean and dangerous. For fifty-six years were these rigorous laws enforced, to the great discomfort of the people, but without result: there was no decrease in consumption. He disclaims the prevalent opinion that married people will contract the disease from one another. Indeed, according to his experience,

it is very rarely indeed that both husband and wife die of consumption. It is worthy of note, however, that whenever facts seem to warrant the assumption of contagion between husband and wife, it is usually the wife who suffers.

The author believes that the operation of all these causes is such that morphological changes are brought about, enabling one years, even decades, in advance, to predict with great probability which members of a given family will be afflicted with pulmonary consumption, and which will remain healthy. When acquired peculiarities through generations have become fixed, then, and in this sense only, does pulmonary consumption become hereditary.

Should these views of the causation of consumption be sustained, the question of contagion, or rather non-contagion, in another decade will no longer be disputed, and then the possibility of the conveyance of phthisis from man to man, in any other way than by direct inoculation, will be looked upon only as a superstition. When such definite conclusions have been reached, we will at last be in a position to study rationally the all-important problem of prevention and treatment.

N. W.

AN important investigation into the chemical constitution of the venom of the Indian cobra (*Naja tripudians*) formed, says the *Lancet*, the subject of a paper read before the Royal Society, on Dec. 16, by Dr. R. Norris Wolfenden. It has been alleged that the venom of this snake contains an alkaloid and a principle known as 'cobric acid.' Dr. Wolfenden has been unable to verify either of these assertions; indeed, he denies the existence of both substances. He further shows that the venom loses its power when the albuminous bodies are removed or otherwise rendered inert. Mixtures containing the cobra poison, when treated with metallic salts that precipitate albumen, were found harmless. Wolfenden, like Weir Mitchell and Reichert, has found three poisonous proteids in the venom. The largest quantity of proteid was a globulin that had asphyxiating properties; and a smaller quantity of syntonin, possessing similar properties, was also detected. A form of serum albumen existed in minute proportions, and this was ascertained to have remarkable powers, paralyzing small animals. It has been objected that the possession of poisonous qualities by a serum albumen is a unique fact, but Schmidt-Mulheim and Albertoni have found ordinary peptones to be toxic when injected into the blood, causing various nervous disturbances, lowering the blood-pressure, and preventing the coagulation of the blood.